Letters to the Editor.

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The Primitive Crust of the Earth.

PROF. COLE's letter in NATURE of July 8, p. 39, concerning the earliest known rocks—a group of sediments—and their relation to the ortho-gneisses, will, I think, call forth the sympathy of students of African geology. In 1904–1905 I came to the conclusion that the para-schists of Southern Nigeria were older than at least the majority of the ortho-gneisses, and searched—without success—for the real foundation-stones which received upon their surface these earliest sediments.

Later I have suggested that the Turoka Series of para-schists of Kenya Colony may prove the oldest rocks of that part of Africa and have thought that, were the main directions of foliation of the ortho-gneiss mapped throughout that continent, we should find, not directions produced by dynamic metamorphism, but directions indicating the upwelling of granitic bathyliths along zones of failure of the primitive crust, *i.e.* foliation swirls on a huge scale akin to those produced by the flood of the Laurentian magma around the disrupted blocks of Grenville sediments. It might be possible to tell what section of the eroded complex was being studied by observations on the frequency of the occurrence of syntectics, the degree of admixture, the proportion of reconstituted sediments to ortho-gneiss, or even by a passage from complete to less complete metamorphism in the invaded rocks.

The newly established surveys of Uganda, Tanganyika Territory and Nyasaland will, one hopes, throw a flood of light upon this fascinating problem of the constitution of the African Archæan.

JOHN PARKINSON.

Athenæum Club, S.W.

Action of Cutting Tools.

MR. MALLOCK's theory of cutting tools (NATURE, August 26, p. 277) is extremely illuminating, but the term "Coefficient of Friction" in his final paragraph seems scarcely justified, as it would imply that the shearing force is always in the same direction and thus independent of the material being cut, of the depth of the cut, rate of feed and tool angles.

In practice even among skilled workers there is considerable variation in the tool angles used, and there is no decided preference by the workman for a tool ground on a fine-grained emery wheel as against one ground on a coarse grindstone; this on very heavy work where the friction might be important. Moreover, the general variation in practical tool angles seems more related to what may be termed the pliability of the material. Thus, for mild steel and wrought iron, angles of 50° to 55° are common, for cast-steel and cast-iron 60° to 65° or 70° are the rule, whereas the brass-finisher's tools are almost flat topped with an angle of 80° to 85°. Copper and aluminium turnings bend very nicely, and thus the sharp tool angle required for them agrees with the pliability theory.

This idea of pliability is not antagonistic to Mr. Mallock's main argument but strongly in support of it, for when a metal yields pliable turnings, these turnings slide on the upper face of the tool a great deal more than when they break off short as in a friable material. Thus the curly turnings of a pliable material may exert more frictional force on the upper face of the tool, but not necessarily because the coefficient of friction is higher. Pliable turnings can slide and thus cause friction: brittle turnings break off with very little sliding. This may be seen very clearly in the rough turning of gun barrels. With certain tool angles and not too heavy a cut, the turnings curl off and are hot, whereas with a more obtuse tool and even a heavier cut the metal crumbles off and is probably not so hot. In the latter case the surface turned has a corrugated periphery showing the periodic impulsive friction on the tool face. The friction theory thus leads to a plausible explanation of certain forms of "chatter." If the friction on the tool face fluctuates on account of either vibration or crumbling of the cutting, and if the system has a natural period in tune with what may be termed the crumbling wave-length, resonance occurs.

But for practical difficulties Mr. Mallock's theory might be of value to investigators of friction, for in no set of actual conditions is it likely that metal slides on metal with more intimate contact than near the point of a cutting tool. Even with cutting lubricants it is doubtful if any liquid reaches the point of the tool unless there is chattering.

In attempting any conception of coefficients of friction between the tool and the cuttings, a further difficulty arises which renders the comparison with clean dry surfaces almost impossible. In some circumstances the cutting of metals produces, in addition to the obvious turnings, a fine smooth powder. This is presumably produced by the abrasion of the cutting on the upper face of the tool, and it may be that this smooth powdered metal acts as a lubricant or ball-bearing for the escaping turning. If so, it would be another of Nature's modes of automatic alleviation—as tears allay the irritation of dust in the eyes, and as the skin is cooled by evaporating sweat.

H. S. ROWELL,
Director of Research,
Research Association of British Motor
and Allied Manufacturers.

15 Bolton Road, W.4, August 27.

The Smoke of Cities.

WITH reference to Prof. Cohen's article on smoke abatement in NATURE of August 26, p. 269, I should be much interested to know why Manchester smoke is qualitatively so much worse than London smoke. Comparing Guy's Hospital and Gower Street with the University of Manchester—the three places of which I have had sufficient experience to judge—I should judge that the quantity of dirt in one's laboratory is about the same; at any rate it is not obviously less in London and, so far as I remember, the published measures of atmospheric pollution confirm this impression. But the Manchester dirt is far more unpleasant and destructive to one's hands, papers, and apparatus. It seems to contain more very fine sticky particles, which get in everywhere and are difficult to clear off: the London dirt is more gritty and granular, makes things dirty enough but is comparatively easily removed. Any one who has spring-cleaned laboratory cupboards in the two places and essayed afterwards to clean themselves will have realised that the dirts are of quite diverse characters. From what Prof. Cohen says I should judge that London smoke is relatively less domestic in origin than the Manchester product, but it seems difficult to reconcile this with what one

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knows of the two places. Does the sort of coal make a difference, or the length of time it is kept before consumption? Or is much of the London dirt dust from other sources than coal fires, dispersed more widely than in the damper Manchester atmosphere?

A. E. BOYCOTT.

Medical School, University College Hospital,
London, W.C., August 28.

PROF. BOYCOTT'S statement is rather surprising; but I cannot think that the explanation is to be found in the larger amount of domestic smoke in Manchester. One would rather expect the reverse, and I can only suppose that the difference between Manchester and London dirt is due to the larger amount of dust not arising from smoke, as Prof. Boycott suggests. Any difference in the quality of coal used in Manchester and London would scarcely have the effect he describes.

The point is an interesting one and I think could be settled by microscopic examination of specimens from the two towns. Soot is easily identified in this way.

J. B. COHEN.

Thwaite Cottage, Coniston Lake, Lancashire,
September 1, 1922.

Waterspouts.

WATERSPOUTS on Lake Victoria are very commonly seen from Entebbe, but at a long distance away, and though I have worked on the lake shores for nearly four years it was only two days ago that I first saw one near enough to be of real interest.

I was in camp on the north end of Bugalla, the largest island of the Sese Archipelago. The camp lay about 300 yards from the shore of a small bay. At daybreak on June 30 there were very lowering black clouds and every indication of an immediate heavy storm. While looking out from the tent I suddenly saw that a waterspout was travelling obliquely towards us, and as it eventually came to within about 100 yards of the shore a very good view was obtained for about five minutes before it came to an end.

The pedicle arose from a well-marked circular area on the water, which was otherwise only faintly rippled by the preliminary puff of wind before the approaching storm.

This circular area was evidently very violently disturbed as a cloud of vapour, greatly agitated, rose from it for a little distance.

The pedicle was extremely narrow at its lower end, and not quite straight, being sinuous in outline. It broadened out gradually into a column which went up into the low cloud; the core of this column was much less dense than the periphery, and the violent upward spiral ascent of the water could be clearly seen.

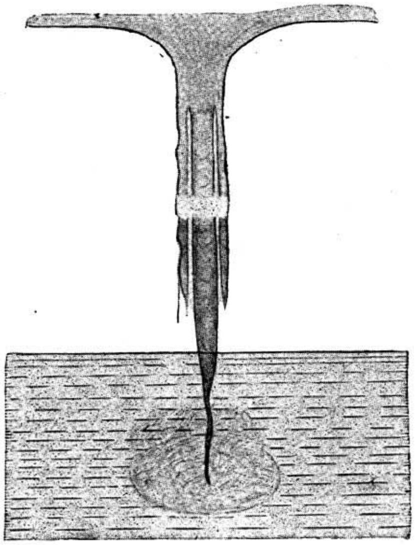
So far I have described nothing unusual, but the following was quite new to me and seemed of great interest.

Surrounding the central core, but separated from it by a clear narrow space, was a sheath, the lower end of which faded away some distance above the water. The profile of this sheath was undulating, it being thicker in some places than others. A curious point is that this sheath *seemed* to pulsate rhythmically, but I could not say whether the appearance of pulsation might not have been an illusion caused by waves travelling up its outer surface.

This pulsation gave an uncanny suggestion of a live thing, which was aided by the violent spiral movement upwards in the central core, the clouds of vapour boiling round its base, and the movement of the whole across the water—indeed, we watched it spellbound until the pedicle dissolved away at the bottom, and the ascent of the part above brought the phenomenon to an end.

My wife watched with me, and is in entire agreement about the curious appearance of pulsation of the outer sheath.

Fig. 1 is a reproduction of a pencil drawing which may give some idea of what we saw. I cannot estimate the height to which the column rose. Its cessation was followed by violent rain and thunder.



G. D. HALE CARPENTER
Uganda Medical Service

Entebbe, Uganda, July 1.

DR. HALE CARPENTER'S letter brings out one feature which has never, to my knowledge, been noted in a waterspout, namely, the sheath, separated from the main body of the whirl by a clear space. Wegener, in his book on "Wind- und Wasser-hosen in Europa," gives illustrations of a large number of waterspouts, but in no case is there mention of two trunks one within the other. The nearest approach to the phenomenon noted by Dr. Hale Carpenter is the not infrequent occurrence of waterspouts which show two clearly defined parts, an upper thick column with a lower whirl of much smaller thickness.

The accepted explanation of waterspouts is that they consist of whirls in rapid rotation with a discontinuity at the outer boundary. The rotation produces a rapid lowering of pressure within the whirl, and consequently a lowering of temperature, which may easily be sufficient to bring the air in the whirl down below its dew point. This is sufficient to explain the main features of the typical waterspout. The amount by which the temperature is lowered decreases outward from the "axis" of the whirl, while the difference between the air-temperature and dew point normally increases downward from the cloud level. The thickness of the visible column or zone of condensation therefore diminishes downward, giving the form of an inverted cone of irregular shape. Near the water the air is again near saturation, and the difference between air temperature and dew point is small, so that the base of the whirl is

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